METHOD AND APPARATUS FOR REMOVING CHLORINE FROM WATER AND METHODS FOR MANUFACTURING THE SAME

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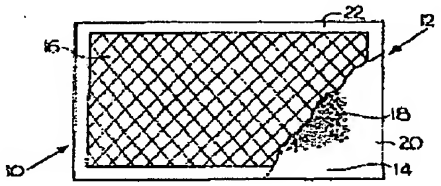
Abstract of WO03084633

A method and apparatus for removing chlorine from water, including an enclosed container (12) with at least a portion of at least one wall (14, 16) manufactured from a porous material, which allows water to flow through the wall, and activated carbon (18) housed in the container (12), wherein the activated carbon (18) has a particle size such that the carbon particles cannot penetrate the wall (14, 16) of the container (12). Also provided is a method of removing chlorine from water, methods of manufacturing a chlorine removal apparatus, and a method of cleaning objects in a vessel.



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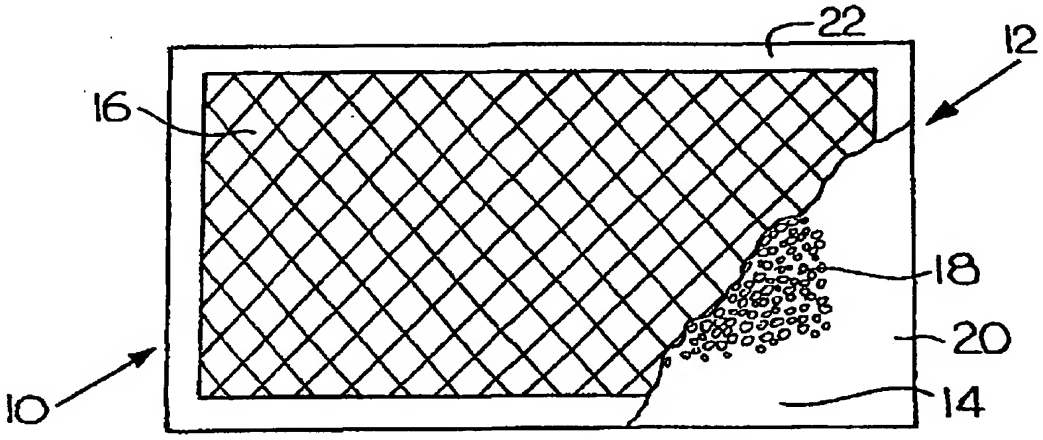
(54) Title: METHOD AND APPARATUS FOR REMOVING CHLORINE FROM WATER AND METHODS FOR MANUFACTURING THE SAME



(57) Abstract: A method and apparatus for removing chlorine from water, including an enclosed container (12) with at least a portion of at least one wall (14, 16) manufactured from a porous material, which allows water to flow through the wall, and activated carbon (18) housed in the container (12), wherein the activated carbon (18) has a particle size such that the carbon particles cannot penetrate the wall (14, 16) of the container (12). Also provided is a method of removing chlorine from water, methods of manufacturing a chlorine removal apparatus, and a method of cleaning objects in a vessel.

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METHOD AND APPARATUS FOR REMOVING CHLORINE FROM WATER AND METHODS FOR MANUFACTURING THE SAME

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates generally to activated carbon used to remove undesirable compounds from water and, in particular, to a method and apparatus for removing chlorine from water and methods of manufacturing such apparatus.

2. Description of the Prior Art

[0002] Chlorine is typically used as the primary oxidizer in drinking water supplies throughout the world. In addition, chlorine is extremely reactive and, thus, tends to degrade the quality of garments that are washed in both residential and commercial laundry facilities. In order to improve the quality of drinking water, methods and devices have been developed to remove chlorine from water prior to consumption. For laundry facilities, chlorine removal is typically accomplished through the addition of chemical reactants to laundry detergent or, in some cases, is left unsolved. When adding chemical reactants to laundry detergent, full chlorine removal is not achieved. Instead, the chemical reactant reacts with the chlorine and creates chloride salts which, although they are not reactive, still remain in the laundry water and may create other problems, such as staining (if iron is present) and corrosion of the laundry equipment. Chlorine removal may also be desirable in dish washing installations.

[0003] Activated carbon has been a technically and economically successful material for treating aqueous and other water systems. Typically, activated carbon is utilized commercially in its granular form in order to remove chlorine from drinking water for the improvement of drinking water taste and quality of the water product. This is primarily done by passing the water through activated carbon in fixed vessel absorbers or in home water filters. However, activated carbon has not been used in connection with washing or laundering devices, such as a washing machine for clothes or other articles.

SUMMARY OF THE INVENTION

[0004] It is therefore an object of the present invention to provide a method and apparatus for removing chlorine from water. It is another object of the present invention to provide a method and apparatus for removing chlorine from the water of a laundering or other washing device. It is another object of the present invention to provide a method and apparatus for removing chlorine without the creation of chlorine salts.

[0005] In order to overcome these deficiencies and others, the present invention is a method and apparatus for removing chlorine from water, in particular, washing water, and methods of manufacturing such an apparatus. The apparatus of the present invention includes an enclosed container with at least one wall having at least a portion manufactured from a porous material, which allows water to flow through the wall, and activated carbon housed within the container. The activated carbon has a particle size whereby the activated carbon cannot penetrate the wall of the container.

[0006] A method of manufacturing a chlorine removal apparatus has been developed and includes: (a) placing a predetermined portion of activated carbon on a first piece of material having at least a portion manufactured from a porous material; (b) placing a second piece of material over the portion of activated carbon; (c) aligning edges of the first piece of material with the second piece of material, thereby aligning respective perimeter area portions of the first and second pieces; and (d) attaching a perimeter area portion of the first piece to a perimeter area portion of the second piece, thereby forming an enclosed container housing the activated carbon.

[0007] Another method of manufacturing a carbon removal apparatus of the present invention includes: (a) placing a predetermined portion of activated carbon on a piece of material having at least a portion manufactured from a porous material; (b) gathering the perimeter portion of the piece of material, thereby creating a bag-like structure with an open end and holding the portion of activated carbon; and (c) fastening the open end of the bag-like structure, thereby forming an enclosed container housing the activated carbon.

[0008] The present invention is also a method of removing chlorine from water, and includes the steps of: (a) providing an enclosed container with at least one wall having at least a portion manufactured from a porous material and having activated carbon housed therein; (b) inserting the container into a holding tank of a device; (c) at least partially filling the holding tank with water; and (d) contacting the water with the activated carbon through the porous wall of the container, such that the activated carbon adsorbs the chlorine from the water. It may also be preferable to agitate the water in the holding tank in order to maximize the contact between the activated carbon and the water in the holding tank.

[0009] The present invention is also a method of cleaning at least one object in a vessel, and includes the steps of: (a) providing an enclosed container with at least a portion of at least one wall manufactured from a porous material and having activated carbon housed within the container, the activated carbon having a particle size whereby the activated carbon cannot penetrate the at least one wall of the container; (b) placing the at least one

object in the vessel; (c) placing the enclosed container in the vessel; (d) at least partially filling the vessel with water; and (e) agitating the at least one object, the enclosed container and the water in the vessel.

[0010] The present invention, both as to its construction and its method of operation, together with the additional objects and advantages thereof, will best be understood from the following description of exemplary embodiments when read in connection with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] Fig. 1 is a top view of a first embodiment of an apparatus for removing chlorine from water according to the present invention;

[0012] Fig. 2 is a side view of the chlorine removal apparatus of Fig. 1;

[0013] Fig. 3 is a side view of a second embodiment of a chlorine removal apparatus according to the present invention;

[0014] Fig. 4 is an exploded perspective view of an intermediate step of a first method of manufacturing the chlorine removal apparatus shown in Figs. 1 and 2; and

[0015] Fig. 5 is a perspective view of an intermediate step of a method of manufacturing the chlorine removal apparatus shown in Fig. 3.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0016] As seen in Figs. 1 and 2, a first embodiment of the chlorine removal apparatus 10 of the present invention includes a container 12 having a first wall 14 and a second wall 16. At least a portion of the first wall 14 and/or the second wall 16 of the container 12 is manufactured from a porous material, specifically, a material which allows water to flow through the walls 14 and 16. In a preferred embodiment shown in Figs. 1 and 2, both the first wall 14 and second wall 16 are porous, increasing water penetration in the container 12. However, the container 12 need only include one or a portion of one of the walls 14, 16 made from a porous or perforated material. This porous material may be fabric, cloth, mesh or any other porous or perforated material, which would allow water to flow in and through the material walls. Within the container 12 and between the first wall 14 and the second wall 16 is activated carbon 18. This activated carbon 18 has a particle size or longitudinal width that prevents the activated carbon 18 from penetrating or exiting porous or perforated first wall 14 or second wall 16 of the container 12. Therefore, water is allowed to flow through and enter the container 12 and contact the activated carbon 18. However, the activated carbon 18 is prevented from penetrating or exiting the container 12 and its walls 14, 16.

[0017] The container 12 can be in any form which allows the container 12 to house the activated carbon 18, and may be in the form of a bag, a sack, a pouch, etc. Similarly, the activated carbon 18 can be in any form which allows the water to contact it and the chlorine in the water to adsorb to the activated carbon particles 18. For example, the activated carbon 18 can be in a granulated form, a chipped form, a pellet form, etc. It is preferable to maximize the surface area of the particle of activated carbon 18 in order to maximize the adsorption characteristics of the particle.

[0018] In this first embodiment, as illustrated in Figs. 1 and 2, the first wall 14 includes a first wall perimeter area portion 20, and the second wall 16 includes a second wall perimeter area portion 22. As seen in Fig. 2, the first wall perimeter area portion 20 is attached to the second wall perimeter area portion 22, thereby creating the sealed and enclosed container 12. The first wall perimeter area portion 20 and the second wall perimeter area portion 22 may be attached or secured together by thermally welded seams, adhesive, staples, thread, etc. In a preferred embodiment, the use of thermally welded seams to hold the first wall 14 and second wall 16 together ensures that the container 12 will not separate during the washing cycle of a laundering or cleaning device.

[0019] A second embodiment of the chlorine removal apparatus 10 of the present invention is illustrated in Fig. 3. In this embodiment, only a single wall 24 is used. Further, the wall 24 is capable of forming a bag-like structure 26, which serves as a pouch and houses the activated carbon 18. As with the first embodiment, the wall 24 (or at least a portion of the wall 24) is manufactured from a porous or perforated material, which allows water to pass through the wall 24, but prevents activated carbon 18 from penetrating or exiting through the wall 24. The bag-like structure 26 has an open end 28, which can be used to fill or refill the bag-like structure 26. After filling or refilling the bag-like structure 26 with activated carbon 18, the open end 28 is sealed using a fastener 30. The fastener 30 may be permanent, semi-permanent or easily removable, and may include typical fasteners, such as thermally welded seams, adhesive, staples, thread, clips, elastic bands, etc.

[0020] Figs. 1-3 show two embodiments of the chlorine removal apparatus 10. It is envisioned that any suitable container 12, which allows water to pass through at least a portion of its walls, and prevents activated carbon 18 from exiting these walls, would be suitable. Various shapes, sizes and configurations are also envisioned. Still further, the chlorine removal apparatus 10 may be a once-through disposable device, or, it may allow for the removal and replenishment of activated carbon 18 from and to the container 12. For example, when using the bag-like structure 26, the fastener 30 may be in the form of a clip or

other removable structure, whereby the user may simply remove the fastener 30, pour out the used activated carbon 18, and refill the container 12 with fresh activated carbon 18.

[0021] The present invention is also directed to a method of removing chlorine from water, and includes the step of providing a container 12, with at least a portion of one wall (depending upon the embodiment) manufactured from a porous material and having activated carbon 18 housed therein. This container 12 is inserted into a holding tank of a device (not shown), and the holding tank is at least partially filled with water. Since the container 12 resides in the holding tank, water is contacted with the activated carbon 18 through the porous portion of the wall or walls of the container 12, and the activated carbon 18 adsorbs the chlorine from the water. It is envisioned that the container 12 can be inserted into the holding tank before, during or after the holding tank has been filled with water. The present method is especially useful in connection with washing machines, such as clothes washing machines or dish washing machines. In order to maximize the contact between the water in the holding tank and the activated carbon 18 in the container 12, it is preferable to agitate the water in the holding tank. Such agitation will shift the activated carbon 18 housed in the container 12, which serves to maximize contact and, therefore, maximize chlorine adsorption by the activated carbon.

[0022] A method of cleaning at least one object in the vessel includes the steps of: providing an enclosed container with at least a portion of at least one wall manufactured from a porous material and having activated carbon housed within the container, the activated carbon having a particle size whereby the activated carbon cannot penetrate the at least one wall of the container; placing the at least one object in the vessel; placing the enclosed container in the vessel; at least partially filling the vessel with water; and agitating the at least one object, the enclosed container and the water in the vessel. Typically, the vessel is an internal holding tank of a washing machine, and the object to be cleaned is a fabric material, such as clothes and the like. In order to clean the objects or clothes in the vessel, the method also includes placing a portion of a cleaning compound in the vessel prior to agitating. For example, this cleaning compound can be a liquid detergent, a granulated detergent, a soap compound and/or a bleaching agent. After the washing machine or vessel has completed its cleaning cycle, the water may be removed from the vessel, and the now-cleaned object or clothes can also be removed. At this point, the user may also remove the chlorine removal apparatus 10 if the chlorine removal apparatus 10 and, more specifically, the activated carbon 18 within the container 12, retains some useful adsorption properties.

[0023] A method of manufacturing the chlorine removal apparatus 10 includes the steps of: placing a predetermined portion of the activated carbon 18 on a first piece of material or first wall 14 having at least a portion manufactured from a porous material; placing a second piece of material or second wall 16 over the portion of activated carbon 18; and aligning edges of the first and second pieces of material or walls 14 and 16, thereby aligning the first wall perimeter area portion 20 and the second wall perimeter area portion 22. Finally, the method includes attaching the first wall perimeter area portion 20 to the second wall perimeter area portion 22, thereby forming the container 12, which houses the activated carbon 18. Fig. 4 illustrates an intermediate step of this method of manufacture.

[0024] Another method of manufacturing the chlorine removal apparatus 10 includes: placing a predetermined portion of activated carbon 18 on a piece of porous material or wall 24 having at least a portion manufactured from a porous material; gathering a perimeter portion of the wall 24, thereby creating a bag-like structure 26 or pouch with an open end 28 and holding the portion of activated carbon 18; and fastening the open end 28 of the bag-like structure 26 with a fastener 30, thereby forming a container 12 housing the activated carbon 18. Fig. 5 illustrates an intermediate step of this method of manufacture.

[0025] The present invention has many benefits. Since the chlorine chemically reacts with the surface of the activated carbon 18, it cannot desorb from the activated carbon 18 and, thus, keeps the laundry water free of chlorine throughout the entire cycle. Additionally, the reaction takes place inside the carbon structure and keeps the byproducts of this reaction away from the clothes, unlike traditional liquid chemical additives. Since the chlorine removal apparatus 10 is small, it is simple to use and does not vary in effectiveness throughout the range of traditional chlorine concentrations in residential and commercial laundry water. The chlorine removal apparatus 10 may be disposable or single-use in nature, or may be refillable. When used in connection with a laundering device, the chlorine is removed only from this laundering device, and is not removed from the home water supply, where it is typically used for its antibacterial properties.

[0026] This invention has been described with reference to the preferred embodiments. Obvious modifications and alterations will occur to others upon reading and understanding the preceding detailed description. It is intended that the invention be construed as including all such modifications and alterations.

THE INVENTION CLAIMED IS:

1. A chlorine removal apparatus, comprising:

an enclosed container with at least a portion of at least one wall manufactured from a porous material, thereby allowing water to flow through the wall; and

activated carbon housed within the container, the activated carbon having a particle size whereby the activated carbon cannot penetrate the wall of the container.

2. The chlorine removal apparatus of claim 1, wherein the porous material is one of fabric, cloth and mesh.

3. The chlorine removal apparatus of claim 1, wherein the container is one of a bag, a sack and a pouch.

4. The chlorine removal apparatus of claim 1, wherein the activated carbon is one of a granulated form, a chipped form and a pellet form.

5. The chlorine removal apparatus of claim 1, wherein the container comprises a first wall and a second wall, with a perimeter area portion of the first wall attached to a perimeter area portion of the second wall, thereby forming the enclosed container.

6. The chlorine removal apparatus of claim 5, wherein the first wall and the second wall are attached together along their respective perimeter area portions by one of thermally welded seams, adhesive, staples and thread.

7. The chlorine removal apparatus of claim 1, wherein the container comprises a bag-like structure with an open end and a fastener sealing the open end.

8. A method of removing chlorine from water, comprising the steps of:

providing an enclosed container with at least a portion of at least one wall manufactured from a porous material and having activated carbon housed therein;

inserting the container into a holding tank of a device;

at least partially filling the holding tank with water; and

contacting the water with the activated carbon through the at least one wall of the container, whereby activated carbon adsorbs the chlorine from the water.

9. The method of claim 8, wherein the device is a washing machine.

10. The method of claim 9, wherein the washing machine is one of a clothes washing machine and a dish washing machine.

11. The method of claim 8, wherein the container is inserted into the holding tank of the device after the holding tank has been at least partially filled with water.

12. The method of claim 8, further comprising the step of agitating the water in the holding tank.

13. The method of claim 8, wherein the porous material is one of fabric, cloth and mesh.

14. The method of claim 8, wherein the container is one of a bag, a sack and a pouch.

15. The method of claim 8, wherein the activated carbon is one of a granulated form, a chipped form and a pellet form.

16. A method of manufacturing a chlorine removal apparatus, comprising the steps of:

placing a predetermined portion of activated carbon on a first piece of material having at least a portion manufactured from a porous material;

placing a second piece of material over the portion of activated carbon;

aligning edges of the first piece of material with the second piece of material, thereby aligning respective perimeter area portions of the first and second pieces; and

attaching a perimeter area portion of the first piece to a perimeter area portion of the second piece, thereby forming an enclosed container housing the activated carbon.

17. The method of claim 16, wherein the perimeter area portion of the first piece is attached to the perimeter area portion of the second piece via one of thermal welding, adhesive, staples and thread.

18. The method of claim 16, wherein the porous material is one of fabric, cloth and mesh.

19. The method of claim 16, wherein the activated carbon is one of a granulated form, a chipped form and a pellet form.

20. A method of manufacturing a chlorine removal apparatus, comprising the steps of:

placing a predetermined portion of activated carbon on a piece of material having at least a portion manufactured from a porous material;

gathering a perimeter portion of the piece of material, thereby creating a bag-like structure with an open end and holding the portion of activated carbon; and

fastening the open end of the bag-like structure, thereby forming an enclosed container housing the activated carbon.

21. The method of claim 20, wherein the porous material is one of fabric, cloth and mesh.

22. The method of claim 20, wherein the activated carbon is one of a granulated form, a chipped form and a pellet form.

23. A method of cleaning at least one object in a vessel, comprising the steps of:

providing an enclosed container with at least a portion of at least one wall manufactured from a porous material and having activated carbon housed within the container, the activated carbon having a particle size whereby the activated carbon cannot penetrate the at least one wall of the container;

placing the at least one object in the vessel;

placing the enclosed container in the vessel;

at least partially filling the vessel with water; and

agitating the at least one object, the enclosed container and the water in the vessel.

24. The method of claim 23, further comprising the step of placing a portion of a cleaning compound in the vessel prior to agitating.

25. The method of claim 24, wherein the cleaning compound is one of a liquid detergent, a granulated detergent, a soap compound and a bleaching agent.

26. The method of claim 23, wherein the vessel is an internal holding tank of a washing machine.

27. The method of claim 23, wherein the at least one object is a fabric material.

28. The method of claim 27, wherein the fabric material is a clothes item.

29. The method of claim 23, further comprising the steps of:
removing the water from the vessel; and
removing the at least one object from the vessel.

30. The method of claim 29, further comprising the step of removing the enclosed container from the vessel.

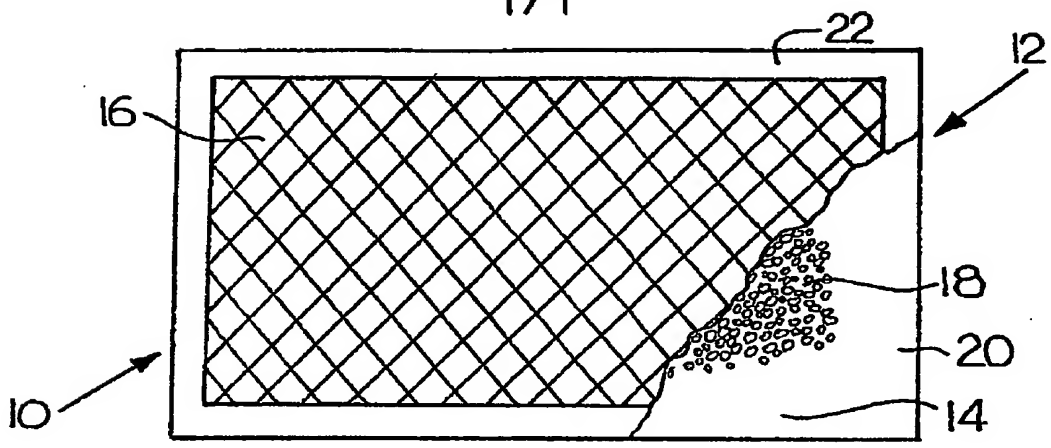

Fig. 1

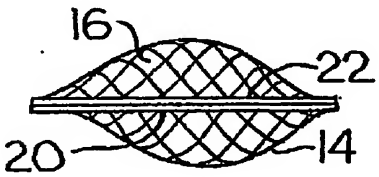

Fig. 2

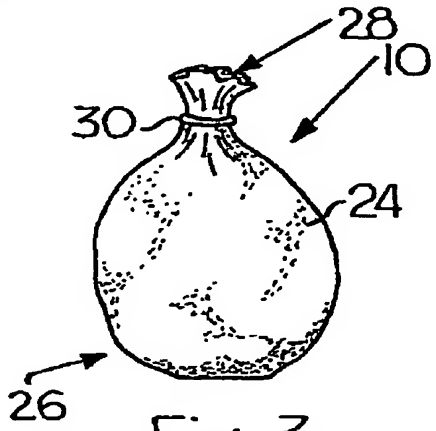

Fig. 3

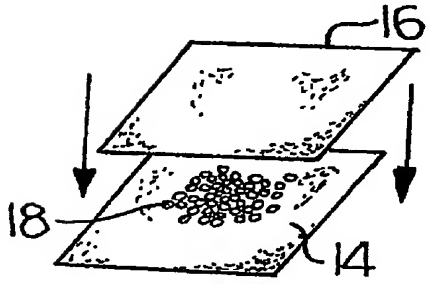

Fig. 4

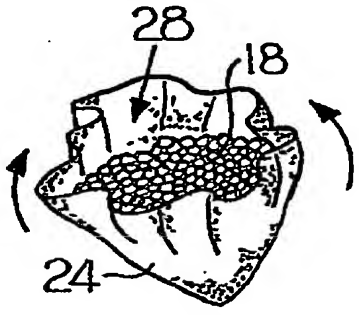

Fig. 5

INTERNATIONAL SEARCH REPORT

International application No.
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A. CLASSIFICATION OF SUBJECT MATTER
IPC(7) : B01D 15/00; C02F 1/28
US CL : 68/13R; 210/660, 282
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
U.S. : 68/13A, 13R, 18F; 210/660, 694, 282, 484

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4,211,649 A (SWAY) 08 July 1980, column 2, lines 21-27; and column 3, lines 3-7.	1-5, 8, 11-16, 18 and 19
Y		6, 7, 17 and 20-22
Y	US 2,214,925 A (GUTRIE) 17 September 1940, Figs. 1-3.	6, 7, 17 and 20-22
A	US 4,062,205 A (MOREY et al.) 13 December 1977.	9, 10 and 23-30

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
22 July 2003 (22.07.2003)	19 AUG 2003
Name and mailing address of the ISA/US Mail Stop PCT, Attn: ISA/US Commissioner for Patents P.O. Box 1450 Alexandria, Virginia 22313-1450 Facsimile No.	Authorized officer Ivars C. Cintins Telephone No. (703) 308-0661

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